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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) establishes the quality assurance (QA) objectives and the quality control (QC) procedures for the soil sampling and analysis that will be carried out at schools and child care facilities in the Soil Safety Program service area of the Tacoma Smelter Plume (TSP). This QAPP is based on the QAPP prepared for the 2002 CUA Study (SAIC 2002) and the QAPP for the Tacoma Smelter Plume Project Extended Footprint Sampling (Ecology, 2004). This QAPP is to be used in conjunction with the Soil Safety Program Design (main document) and Sampling Design (Appendix A), and a field sampling plan and health and safety plan for each participating county.

The TSP is primarily contaminated by arsenic and lead. The sampling and analysis project governed by this QAPP will provide chemical data needed to support assessments of play areas at schools and child care facilities, and decisions on best management practices (BMPs) based on potential risk determinations at those facilities.

2.0 PROJECT ORGANIZATION AND SCHEDULE

The project team, consisting of representatives of Ecology, Public Health-Seattle & King County (PHSKC), and Tacoma-Pierce County Health Department (TPCHD), have jointly developed the Soil Safety Program Design, Sample Design, QAPP, and associated documents with Landau Associates as consultant and facilitator. Soil sampling will be conducted by PHSKC and TPCHD (jointly referred to in places within this document as "the counties"). The counties will be responsible for submitting samples to the laboratory, tracking samples, receiving the hard copy and electronic data reports from the laboratory, and data verification. PHSKC and TPCHD will transfer electronic and relevant field data to their internal databases and will provide electronic submittals of the data to Ecology in Ecology's Environmental Information Management System (EIM) format. Ecology will provide technical assistance for data submittals to EIM. At the end of the sampling effort, the counties will provide hard copies of data reports to Ecology, who will act as final repository for hard copy data. For both King and Pierce County samples, the laboratory will be contracted through TPCHD. Ecology will provide project oversight and coordination.

Sampling in both counties is scheduled to begin in summer, 2006, and be completed by December 31, 2009. The final batch of data shall be provided to Ecology by the counties by October 31, 2008, so that Ecology may provide a report to the legislature by December 31, 2008.

3.0 SAMPLING PROCEDURES

The procedures that will be followed for collection, preservation, transportation, and storage of the soil samples and associated field QC samples will be described in the project implementation plans developed by each county. This includes procedures for sample custody and chain of custody documentation, sample management and tracking, and recording field and sample handling data in field notebooks and on field data forms. Specifications for identifying sampling locations, number of borings, and sample depth are included in the Sample Design (Appendix A). Field methods for collecting the sample are similar for both counties Specifically, Pierce County obtains the samples with a stainless steel coring device which is pounded into the ground with a hammer, while King County obtains samples with a stainless steel hand auger. In both cases, the surface vegetation or humic layer is removed and soils are collected evenly across the 6 inch depth. The entire core is either placed into the jar, or if there is too much soil to fit into one sample jar, the soils are homogenized in the field and a subsample is deposited into the sample jar.

3.1 SAMPLE NUMBERING SCHEME

A consistent scheme for sample numbering will be used by both counties. The sample identification scheme is described below:

1. County (Pierce = 27; King = 17; Thurston= 34) (numbers are standard county codes);
2. Facility Code: the sequential number assigned to each facility through Ecology's Soil Safety tracking database. The facility code also signifies the type of play area –

   0001 to 1000 = schools

   1001 to 8000 = childcares

   8001 to 9999 = parks or camps (for those childcares with offsite play areas at nearby park or camp)

3. Play area number: 1, 2, 3, 4, etc.
4. Boring number: 1, 2, 3, 4, etc.
5. Depth interval (required for KC database structure) 1 = 0-6"
6. Sample type 4 = regular, 5= duplicate

Example: 27-0001-1-1-1-4 = Pierce County, facility 0001, play area 1 (school), boring 1, depth 1, regular sample.

Example: 17-1005-2-8-1-5 = King County, facility 1005 (child care), play area 2, boring 8, depth 1, duplicate sample.

3.2 SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

The allowed holding time for all samples is 180 days after sample collection. No sample preservation is required. Containers will be glass jars provided by the laboratory. Pierce County will homogenize the soil contents collected from the coring device and then subsample from that into a 4 ounce jar. King County will deposit the entire contents of the hand auger into an 8 ounce jar and submit to the lab to be homogenized there. If there is too much sample to fit into the 8 ounce jar, the contents of the auger will be homogenized first, then a subsample deposited into the sample jar.

3.3 LOCATIONAL DATA

Ecology will use address matching software to identify a latitude/longitude for the facility – and enter this into the Soil Safety tracking database (not EIM). (If a school or childcare does not respond to access requests, or denies access, we will still be able to plot the facility.) For those facilities that grant access, the counties will use GPS during the qualitative assessment to verify the latitude/longitude of the facility, or confirm the coordinates on orthophotos. The verified coordinates for that facility will then be input by the counties into the Soil Safety tracking database. If the qualitative assessment determines that soil sampling is not necessary, then the coordinates will be taken from the front door of the facility, or centroid of parcel if generated using orthophotos or other mapping system. If the qualitative assessment determines that soil sampling is necessary, then the coordinates will be identified for each play area (for EIM), either using GPS or orthophotos. For the Soil Safety tracking database, the coordinates for the first play area will be used.

4.0 ANALYTICAL PROCEDURES

Prior to digestion the entire soil sample will be removed from its container, sieved as is through a 2mm sieve, then homogenized. This procedure is consistent with MTCA protocols [WAC 173-340-740(7)(d)]. The portion of the sieved homogenized material that is not needed for the primary analysis will be returned to the original container and returned to the sample storage area. The samples will then be prepared using a microwave digestion technique (USEPA SW 846 Method 3051A). Total arsenic and lead in the soil samples will be analyzed by ICP-mass spectrometry (ICP-MS) (USEPA method 6020). The reporting limits (RL) for this project will be the practical quantitation limits (PQL), of 1.0 mg/kg for arsenic and 0.5 mg/kg for lead. Percent moisture will be determined for each sample and sample results will be reported on a dry-weight basis. The percent moisture determination will be performed and reported for all soil samples using the EPA CLP ILMO4.0 method or equivalent.

5.0 QUALITY OBJECTIVES AND QUALITY CONTROL PROCEDURES

The analytical results from this project will be used to determine average and maximum arsenic and lead concentrations for soils in play areas. The average of all samples in a play area, and the maximum result of the play area will be used to determine actions needed to provide protection against risks from exposure to the contaminated soil. The sample design is not meant to provide full MTCA characterization of soils at the play areas, and as such is considered to be 'screening level' sampling. However, it is important to ensure that the sample results are of sufficient quality to provide a high degree of confidence that no sites with contamination above acceptable risk levels are left behind, or that sites without contamination are mistakenly included in the program (with its associated costs to the Counties and Ecology). The measurement quality objectives and quality control procedures outlined below will be implemented to achieve this goal.

Measurement quality objectives (MQOs) are qualitative or quantitative statements of the precision, accuracy (or bias), sensitivity, representativeness, completeness, and comparability necessary for the data to serve the objectives of the project. The MQOs and quality control procedures identified for this project are listed in the following subsections and are summarized in Table 1. In addition to the laboratory quality control procedures listed in Table 1, the laboratory shall follow all other quality control measures for instrument calibrations or lab performance that are specified in Method 6020, and according to the laboratory's Standard Operating Procedures. If a sample batch does not contain 20 Soil Safety Program (SSP) samples, samples from other projects may be added to that batch but QC samples must be run on the SSP samples.

5.1 PRECISION

Precision is a measure of the reproducibility of an analytical result (i.e., the ability to obtain the same or similar results on replicate measurements of the same sample or of duplicate samples). Matrix variations, sample preparation procedures, and the analytical method affect reproducibility. Precision is measured by the variability in results between replicate analyses (e.g., the relative percent difference between duplicates).

5.1.1 FIELD PRECISION

Field precision will be assessed through the analysis of duplicate field samples collected from a particular sampling point. For these duplicates a single soil core will be homogenized in the field, then split into a primary and a duplicate sample and submitted to the laboratory to be analyzed as two separate samples. A minimum of one duplicate per twenty samples will be collected. In the final data evaluation, only the results from the primary sample and not the duplicate sample will be considered. The MQO for the field duplicates will be a relative percent difference (RPD) no greater than ± 50 percent for each target element in the samples.

5.1.2 LABORATORY PRECISION

Laboratory precision will be evaluated by analysis of laboratory duplicates. Analysis and comparison of laboratory duplicates will evaluate laboratory precision within an analytical data group (batch). Laboratory duplicates will be analyzed for one sample in twenty (i.e., 5 percent) or one per batch of samples analyzed, whichever is more frequent. Target laboratory precision objectives for laboratory duplicates, expressed as RPD, are 35 percent for each sample and element.

For determining percent moisture, a duplicate moisture analysis must be performed at a frequency of at least one per batch or one per twenty samples, whichever is more frequent. The relative percent difference (RPD) shall not exceed 20 percent, or the percent moisture determination of the samples in that batch will need to be redone.

These objectives are consistent with levels of precision normally achievable by the standard EPA methods selected for this project. Duplicates with RPD values in excess of these control limits may indicate a lack of precision resulting from sampling or analysis techniques, and the results should be evaluated accordingly. In these cases, determination of the usability of the data for decision-making will include consideration of the difference between the concentrations in the samples and the corresponding decision criteria.

5.2 ACCURACY

Accuracy is defined as how close a measured parameter is to its true value. The accuracy of a measurement is affected by a combination of random error (precision, as discussed above) and systematic error (bias). Potential sources of bias include imperfect sample collection methods (such as equipment cleaning), chemical instability of the samples, and interferences (matrix effects).

TABLE 1
QUALITY CONTROL ELEMENTS – ARSENIC AND LEAD IN SOILS BY SW 846 METHOD 6020

	Quality Control Test	Minimum Frequency	Acceptance Criteria	Corrective Action
Precision	Field Duplicates	1 per 20 samples collected (5%)	50% Relative percent difference (RPD)	Qualitative review by County staff to gauge effect on overall project precision. Only result for primary sample will be used in data evaluations.
	Lab Duplicates	1 per 20 samples (5%), or 1 per extraction batch (whichever is more frequent)	35% RPD, if concentrations of both are > 5 x reporting limit (RL). If either the sample or duplicate result is < 5 X the RL, the difference in the concentrations must be less than 2 X the RL.	If sample or duplicate is > 5x RL, and if results are >20% RPD, then reanalyze batch. If similar results, flag samples accordingly. If sample or duplicate is <5x RL, and difference is >2x RL, flag associated samples accordingly.
Accuracy	Matrix Spike	1 per 20 samples (5%), or 1 per extraction batch (whichever is more frequent)	Where the native sample concentration is less than 4 X the amount spiked, the %R must be 75% to 125%. For analytes where the native sample concentration is greater than 4 X the amount spiked, no evaluation will be made	If MS is outside of control limits, will report blank spike results (if w/in acceptable limits) and flag samples accordingly. If blank spike is out of limits, then reanalyze entire batch.
	Standard Reference Materials	1 per 20 samples (5%), or 1 per extraction batch (whichever is more frequent)	Analyte results must be within manufacturers certified acceptance limits	Redigest and reanalyze associated samples
	Lab Control Sample/Blank Spike	1 per 20 samples (5%) or 1 per extraction batch (whichever is more frequent) (May be done in addition to SRM, but not replace SRM)	% Recovery of 80 - 120%	If out of control limits, reanalyze associated batch. If still out of limits, flag samples accordingly.
	ICP Serial Dilution	1 per 20 samples (5%), or 1 per extraction batch (whichever is more frequent)	When original sample result is > 50 x mdl, then Rpd between undiluted & diluted <10% or suspect matrix interference.	Redigest & reanalyze associated samples. If fails, then evaluate results post digestion spike. Flag if RPD > 10%
	Method Blanks	1 per 20 samples (5%), or 1 per extraction batch (whichever is more frequent)	Absolute value of blank result < RL, or associated sample results must be > 10 times blank concentration.	Reanalyze batch.

TABLE 1
QUALITY CONTROL ELEMENTS – ARSENIC AND LEAD IN SOILS BY SW 846 METHOD 6020

	Quality Control Test	Minimum Frequency	Acceptance Criteria	Corrective Action
Representativeness	Qualitative measure. Sample design plan has considered representativeness in sample layout and allocation and in identifying the boundaries of a play area. A qualitative review of each facility will determine which areas to sample to be representative of the area children are playing in. Sampling from the top 0-6" of soils represent the soils children are most likely to come into contact with on a regular basis.			
Comparability	Sample methods, sample design, analytical procedures match that of past projects, except that this project will not include sampling at two depth horizons (0-2" and 2-6"). Instead will obtain sample from 0-6". Evaluation of previous data for two horizons indicates very small difference between two horizons, so only one will be sampled in this study.			
Completeness	Valid samples taken from 100% of facilities where qualitative evaluation indicates sampling is warranted. Valid measurements obtained for at least 90% of all samples submitted to lab.			
Sensitivity	Practical quantitation limits of 1.0 mg/kg for arsenic and 0.5 mg/kg for lead will be appropriate for comparing sample results to MTCA Method A cleanup levels of 20 and 250 ppm.			

5.2.1 FIELD PROCEDURES

The potential for introducing bias will be minimized by adherence to established procedures for collection, preservation, transportation, and storage of samples (per each county Implementation Plan).

5.2.2 LABORATORY PROCEDURES

Bias due to sample matrix effects will be assessed by spiking a sample with target elements of known concentration and calculating the percent recovery (matrix spikes). In addition, analytical bias will be assessed by analyzing a standard reference material (SRM) and calculating the percent difference between the measured value and the known value of the standard. SRMs are purchased samples of a similar matrix as the field samples with certified, known concentrations. The use of SRM samples will be as follows:

> *The SRM will be prepared and analyzed with each analytical batch of samples, and the results of the analysis must be within the performance acceptance limits, as published by the supplier of the SRM, that correspond to the digestion procedure used by the laboratory. If SRM results are outside the acceptance limits, the entire analytical batch, including a new aliquot of the SRM, all associated samples, and all QC samples, will be redigested and reanalyzed. In cases where an analytical batch of samples must be redigested and reanalyzed, the laboratory must notify the designated project QA officer at the appropriate agency within 24 hours.*

Matrix spike samples and SRMs will be analyzed for no less than one sample in twenty (i.e., 5 percent) samples or one per batch analyzed, whichever is more frequent. Target laboratory accuracy objectives for matrix spike recoveries, expressed as percent recovery of the known spike amount, are 75 percent to 125 percent for each sample and element, except that, for analytes where the native sample concentration is more than four times the amount spiked, no evaluation will be made. For the SRMs, the measured concentration must be within the manufacturer's certified acceptance range.

Laboratory accuracy (as bias) will also be assessed by analysis of procedure (method) blank samples. A method blank sample is an aliquot of a known clean soil, sand, or deionized water sample that is prepared, digested, and analyzed along with an analytical batch of samples. The method blanks are analyzed to indicate potential sample contamination from contaminated laboratory equipment. Positive contamination from laboratory equipment would indicate a potential high bias to associated data. At least one method blank sample will be prepared and analyzed along with each analytical data group (batch).

5.3 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data accurately represent the environmental conditions and variations within the sampling area. Representativeness is a qualitative parameter that is most affected by proper design of the sampling program. The representativeness criterion is best satisfied by making certain that sampling locations are selected properly and a sufficient number of samples are collected. The samples for this project will be collected in accordance with the sampling strategy specified in the main text and Appendix A of this document. The strategy has been developed to identify priority sites and provide data that are representative of the conditions within a site.

5.4 COMPARABILITY

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. Sample data should be comparable with other measurement data for similar samples and sample conditions. Comparability within this project and to past projects will be maintained by employing an Ecology-accredited laboratory, use of the same EPA-approved analytical methods, consistent reporting limits, consistent units, and consistent sampling methodologies. Comparability is affected by the other DQO parameters because only when precision and accuracy are known can data sets be compared with confidence. One aspect where data from this program will not be directly comparable with prior studies is in that prior studies evaluated soils from two depth horizons, 0-2", and 2-6". During the design process for the Safe Soils Program, the project team determined that the results from the two horizons were not significantly different, so that testing from one, combined, soil horizon was appropriate for this program.

5.5 COMPLETENESS

Completeness is a measure of the amount of valid data obtained from a sampling and analysis program, expressed as a percentage of the number of valid measurements that should have been obtained In general, completeness can be impacted by the number of field samples collected as opposed to the number planned, as well as by the number of valid analytical measurements obtained as compared to the number requested. For field sampling, the goal will be to obtain valid samples from 100% of facilities where the qualitative evaluation indicates sampling is needed For analytical measurements, the target overall completeness objective for this project is 90 percent.

6.0 DATA REDUCTION, REVIEW, AND REPORTING

The process of data reduction, review, and reporting is applicable to all aspects of the project (field activities, laboratory analyses, analytical data validation) and is required for both project information and technical data. Project information (e.g., field logbooks, storage records, project tracking records) will be maintained to verify adherence to both field and laboratory protocols.

Technical data from field and laboratory analyses will be combined to characterize the contamination at the properties. Documented verification of these data is crucial. Consistent, documented data reduction techniques, for both hand calculations and computer analyses, and standardized technical data review are equally important in the verification of the technical data.

The following sections describe the process of handling field and laboratory data in terms of data reduction, review, and reporting.

6.1 DATA REDUCTION

Data reported by the laboratory and data collected in the field will be reduced by manual and computerized calculations. Procedures for ensuring the correctness of the data reduction process will include the following:

- Data will be reduced either manually on calculation sheets and field logbooks or by computer in spreadsheets or databases.
- Technical personnel will document and review their own work and are responsible for the correctness of the work.
- Calculations will be checked for methodology and accuracy, prior to use in reports, by an engineer or scientist of a professional level equal to or higher than that of the person who performed the calculation.
- The Project Manager at the laboratory will be responsible for ensuring that lab data reduction is performed in accordance with this QAPP.
- The field staff and project managers at the county health departments will be responsible for ensuring that field data are recorded and documented appropriately.

6.2 LABORATORY DATA REVIEW

Data generated by the laboratory will be reviewed prior to their release. In-laboratory data reduction and review will be conducted by the laboratory in accordance with the review processes documented in its Quality Assurance Manual. At a minimum, the laboratory will perform the following levels of data review:

- Analytical level (bench level chemist)
- Data section level (laboratory section supervisor)
- Final quality review (laboratory project manager or laboratory QA officer).

This review shall include the following procedures and elements:

- Primary review documented on data review worksheets.
- Secondary review performed by peer reviewer; documented on a secondary review checklist.
- Review of the data validation report by a qualified data review specialist or the laboratory QA officer; documented on a Report QC and approval checklist.

Review and approval for release by the laboratory project manager; documented by signature on transmittal memo.

6.3 LABORATORY REPORTING

The laboratory will submit an electronic data delivery (EDD), in a format mutually agreed upon, to the respective county health department staff within 30 days of sample receipt, followed by a hard copy of the data package. The laboratory shall perform quality control assessment of its Electronic Data Deliverable before transmitting to the counties.

Hard copies of analytical data deliverables from the laboratory will include items listed in Attachment 1 (Laboratory Data Package Deliverables). All data packages must be complete, legible and of sufficient quality to undergo evaluation by an independent, third party validator, if it is later determined to be necessary. Incomplete, illegible or unusable data packages will not be accepted, and will be returned to the laboratory for correction. Minor clarification and corrections to the data package, which are requested by the county project managers, will be provided by the laboratory within three (3) calendar days of the request.

Completed data packages from the laboratory will include a list of samples numbers covered in the data package, a narrative outlining any problem, corrections, anomalies, description and discussion of data qualifiers and conclusions, as well as chain-of-custody documentation. The narrative will describe results of quality control samples and compare them to quality control limits. Each hard copy data package will clearly state which electronic data delivery it is associated with. All data package pages will be sequentially numbered.

7.0 DATA MANAGEMENT

This section describes the procedures to be used to document and track chemical data. The objective of these procedures is to assure that all data collected during the project are processed and archived in a manner that assures data quality, security, and retrievability, thereby assuring information integrity.

Maintaining data integrity involves all aspects of the project beginning with the collection of the first sample and continuing through archiving the electronic and hard copy results. Three primary tasks will be carried out to ensure data integrity throughout the duration of the project: sample management, management of hardcopy forms of data, and electronic data management.

7.1 SAMPLE MANAGEMENT

Sample management will involve monitoring and tracking of samples through the chain-of-custody process, from the time they are collected, through final disposal of samples after data have been reviewed and determined to be adequate. Each County will specify its procedures for storing, delivering, and tracking samples in their Field Sampling Plans. It will be the responsibility of every individual who handles the samples to ensure that chain-of-custody forms are filled out accurately and completely. **Attention to detail when transcribing sample numbers is of the utmost importance.** In addition to chain-of-custody forms, the laboratory will send confirmation e-mails to the client Health Department indicating which samples have arrived at the lab and the dates of their arrivals. The Health Department project coordinator will assure the following sample management tasks are conducted:

- Ensuring that samples are stored in a secure environment at the proper temperature until delivery to the lab.
- Accurately tracking the transport of field samples to the laboratory through chain-of-custody documentation and confirmation e-mails.
- Reviewing sample confirmation e-mails and comparing them to field logbooks and sample numbers and dates entered into the database for that week.
- Confirming that all requested procedures, analysis, and re-analysis are performed.

Samples will be analyzed within 20 days of delivery and electronic results will be provided to the Health Department within 30 days of receipt at the lab. The lab may hold small groups of samples for short periods of time to combine with other samples received from the Counties to complete the sample batch. The lab will store the samples after analysis until notified by the Counties that the electronic and hard copy deliverables have been reviewed and are acceptable.

7.2 MANAGEMENT OF HARD COPY DATA

Field data will be recorded in field log books and on standard forms. Relevant portions of the field data will be transferred manually to the Counties' databases. Copies or originals of the field data will be sent to Ecology at the end of the project, or on a mutually agreed-upon schedule, for appropriate long-term storage

Hard copies of laboratory data, according to the list in Attachment 1, will be submitted to the counties by the laboratory following the electronic data delivery. The project managers at each county will review the hard copy data for completeness upon receipt and obtain complete information from the lab if needed. These laboratory deliverables and other hard copies will be stored and maintained in organized files until data reporting to Ecology is completed, at which time all hardcopy materials will be sent to Ecology for appropriate storage pertinent to the Administrative Record for the TSP Site.

7.3 ELECTRONIC DATA MANAGEMENT SYSTEM

Computer-based data management systems using relational database software at Pierce and at King Counties' health departments will be used for this project to store the results of the laboratory chemical analyses and associated field information. An electronic version of the laboratory chemistry data will be supplied by the laboratory to the Counties in a format which is compatible with the counties relational databases, to be agreed upon prior to project commencement. The information compiled in the database for the field locations and chemical analysis results will include, at a minimum, the fields necessary to populate Ecology's Environmental Information Management database. Ecology will provide technical assistance to the Counties to ensure the appropriate fields and formats are included in the databases for transfer to EIM. Data will be transferred to EIM by each county's data manager using the internet data submittal function of EIM, with assistance from Ecology if needed. Data transfer will occur on a schedule mutually agreed to by Ecology and each Health Department.

The master copy of the electronic databases from each county will reside on a secure network through the duration of the project. The database will be backed up regularly.

7.3.1 DATABASE ENTRY AND VALIDATION

Only the data manager or personnel authorized by the data manager at each health department will be permitted to update or edit the database. Other personnel who need to use the computerized data will be prohibited from altering the data and structure of the database; user entry restrictions will be built into the database software and will be set to grant read-only privileges to such users.

Information will be loaded into the database promptly following the receipt of the data from the field or laboratory. Some data entry will be accomplished manually, but the majority will be downloaded into the database from the laboratory electronic data deliverables. Data entered manually from documents and field forms will be checked to assure that correct data transcription has occurred. After the entries are complete, a person other than the data entry person will verify 100 percent of all hand-entered data against hardcopy.

Electronically loaded data will be compared to hardcopy forms of the data as well as the source EDD to confirm correct transfer. It is the responsibility of each party who handles samples or data to ensure that all data transmissions and transcriptions are correct and accurate. It is especially important to compare EDDs to hardcopies or their original files that have not been through an electronic transfer This ensures that any errors created during the electronic transfer are corrected.

Additional data QC checks to be performed by the health departments include:

- Comparing sample numbers and dates indicated in confirmation e-mails from the laboratory with those entered into the database from field logbooks and chain-of custody forms.

- Review of hand-entered data by at least one other project staff member.

8.0 PERFORMANCE AND SYSTEM AUDITS

The designated project manager at each county health department will monitor the performance of the field and information management activities. This will be achieved through review of field logs, internal coordination meetings to ensure practices are consistent, and review of data quality narratives and results from the laboratory.

Since the laboratory used for this project must be certified by the State of Washington (either directly or through reciprocity), and is audited by the certifying agency at least annually, a project audit is not anticipated. On-going project performance will be determined through laboratory quality assurance and quality control measures.

9.0 DATA ASSESSMENT PROCEDURES

9.1 PROJECT STAFF DATA REVIEW

All data deliverables generated for this project will be reviewed by the health department project staff for completeness and accuracy. The hard copy and electronic data packages will be evaluated for completeness and for consistency with the project quality control requirements described in Section 3 and in Table 1. Mistakes or inconsistencies discovered will be reported to the laboratory by the county project staff by email, specifically noting what problem was identified and requesting correction by the laboratory. Ecology will be copied on all requests for correction, and their resolution.

Each data package will be reviewed for:

- Completeness (according to Attachment 1, for hard copies)
- Analytical holding times from summary forms (met or not met)
- Chain of custody (COC), sample handling, and ensuring that all samples have been analyzed for the requested analytes.
- Analytical accuracy [i.e. matrix spike compounds and standard reference materials, expressed as percent recovery (%R)] from summary forms. (Review of lab calculations and spot check calculations, compare to acceptance limits).
- Analytical precision (i.e. comparison of duplicate sample results) expressed as relative percent difference (RPD) from summary forms. (Review of lab calculations and spot check calculations, compare to acceptance limits).
- Relative percent difference calculations for field duplicate samples.
- Reporting limits (RL's) – (identify range and compare to acceptance limits.)

Each county will develop a review checklist with the above elements for data quality assessment and will attach it to each hard copy data package. It is recommended that each county perform a summary review of data quality and completeness when the electronic deliverable is provided from the lab to catch problems early on.

A summary of the quality control reviews, consisting of copies of the completed checklists and a short narrative describing any quality control issues and their resolution, will be submitted to Ecology by each county with their quarterly grant reports.

Calculation of quantitative measures of data quality is reviewed below.

9.1.1 PRECISION

The results from field duplicate analyses and laboratory duplicate analyses will be used to determine the relative percent difference (RPD) between the pair of analyses. The RPD for field duplicates will be used as a measure of field precision and the RPD for laboratory duplicates will be used as a measure of analytical precision. The RPDs will be calculated as follows:

$$\text{RPD}(\%) = \frac{100\,(C1 - C2)}{[(C1 + C2)/2]}$$

Where:

RPD	=	relative percent difference
C1	=	the higher concentration measured for the duplicate samples
C2	=	the lower concentration measured for the duplicate samples

Only the results from the primary sample will be used for project decisions.

9.1.2 ACCURACY

For spiked samples (matrix spikes and lab control samples), the percent recovery (% R) will be used as the measure of accuracy and is calculated as follows:

$$\%R = [100\,(Cs - Cn)]\,/\,Csa$$

Where:

% R	=	percent recovery
Cs	=	measured concentration in spiked aliquot
Cn	=	measured concentration in non-spiked aliquot
Csa	=	actual concentration due to spike added

The percent difference (% D) for analysis of SRM samples will be used as an additional measure of accuracy and is calculated as follows:

$$\%D = [100\,(Csrm - Cm)]\,/\,Csrm$$

Where:

% D	=	percent difference
Cm	=	measured concentration in SRM aliquot
Csrm	=	certified SRM concentration

9.1.3 COMPLETENESS

The measure of completeness will be based on the number of environmental soil samples submitted to the laboratory for analysis, and will be calculated as follows:

$$C\ (\%) = \frac{100\ (\text{Number of acceptable measurements})}{(\text{Number of samples submitted})}$$

10.0 CORRECTIVE ACTION

It is the intent of the quality assurance process to minimize the need for corrective action through the development and implementation of effective internal controls. To accomplish this goal, corrective action procedures will be implemented, as described in this section, for each measurement system. The corrective action procedures will involve the following steps:

1. Discovery of a nonconformance
2. Identification of the cause or responsible party.
3. Plan and schedule corrective measures.
4. Confirmation that the corrective measures achieved the desired results.
5. If nonconformance is discovered after initial submission, resubmission of corrected data will be required.

Activities subject to quality control and quality assurance will be evaluated for compliance with established procedures and acceptance criteria described in the FSP, this QAPP, and the laboratory quality assurance manual. A lack of compliance with these procedures will constitute nonconformance. Any project team member who discovers or suspects a nonconformance is responsible for requesting a corrective action. The County Health Department Project Coordinator will ensure that no additional work that is dependent on the non-conforming activity is performed until corrective action is implemented.

10.1 FIELD CORRECTIVE ACTION

The initial responsibility for monitoring the quality of field measurements and procedures lies with the field personnel. Each technical staff member is responsible for verifying that all QC procedures are followed. The technical staff member will assess the correctness of the field methods and the ability to meet QA objectives while conducting the work. If a problem occurs which might jeopardize the integrity of the project or cause a quality assurance objective not to be met, the technical staff member will notify the project manager. Corrective measures will be determined and implemented as appropriate. The technical staff member along with the project manager will document the problem, the corrective measures, and the results. Documentation will be through use of a corrective action form, unless the problem is determined to be minor, in which case documentation in a field logbook may be done instead.

10.2 LABORATORY CORRECTIVE ACTIONS

The need for corrective actions in the analytical laboratory may come from several sources: equipment malfunction, failure of internal QA/QC checks, method blank contamination, failure of performance or system audits, and/or noncompliance with QA requirements. When measurement equipment or analytical methods fail QC checks, the problem will immediately be brought to the attention of the appropriate laboratory project manager and other persons in the laboratory in accordance with the laboratory's quality assurance manual. If failure is due to equipment malfunction, the equipment will be repaired, precision and accuracy will be reassessed, and the analysis will be rerun. Attempts will be made to reanalyze all affected parts of the analysis so that, in the end, the product is not affected by failure to meet QC checks. The laboratory project coordinator will ensure that no additional work that is dependent on the non-conforming activity is performed until corrective action is implemented.

In the following situations, reanalysis will automatically occur:

- Linear range exceeded; sample dilution required.
- Method blank contamination (blank concentration is greater than the reporting limit and sample concentrations are less than 10 times the blank concentration).
- Percent recovery of SRM is not within the acceptable performance limits.
- Calibration verification samples not within control limits.

All incidents of QC failure and the corrective actions will be documented, and reports will be placed in the project file and sent to the County Health Departments along with the data hardcopies. If, at any time, the QA/QC criteria outlined in this QAPP are not met and the laboratory corrective action does not resolve the problem, the County Health Department project manager will be notified and a corrective action report initiated.

11.0 REFERENCES

Ecology, April 2004, Quality Assurance Project Plan, Tacoma Smelter Plume Project, Extended Footprint Sampling. Prepared in conjunction with Tacoma-Pierce County Health Department, Kitsap County Health Department, Public Health- Seattle & King County, and Thurston County Health Department

SAIC, 2002. Final Quality Assurance Project Plan for Work Assignment No. SAI28, Contract No C9800045, Child Use Area Sampling Program, Tacoma Smelter Plume Investigation, Pierce and King Counties, Washington. October.

EPA. 1994. USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review. EPA 540/R-94/013. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. Washington DC. February.

ATTACHMENT 1

LABORATORY DATA PACKAGE DELIVERABLES

Deliverable Requirement
Case narrative
Cross reference of the field sample ID number, laboratory sample number, and analytical batch
Chain-of-custody forms
Sample results
Blank results: Initial, continuing, and preparation
Initial calibration data
Continuing calibration verification data
Internal standard results (ICP-MS only)
Interference Check Sample results
Matrix spike results
Duplicate sample results
Laboratory Control Sample (LCS) results
SRM results and manufacturer's Certification of Analysis
Serial dilution results
GFAA Post digestion spike results
GFAA Standard Addition results (MSA)
Instrument Detection Limits
Linear ranges
Preparation log (including percent solids)
Analysis run log
Standards preparation sheet/logs
ICV, CCV, and ICSAB True Values
Raw data and instrument printouts
All pages must be numbered sequentially.